



Implementing ADS-B in the NAS

***A description of the Federal Aviation Administration's plans
for implementing ADS-B throughout the NAS***

February 2003

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Why Does the Aviation Community and the FAA Want ADS-B?

- **ADS-B is an enabler for free flight**
 - It can increase capacity & efficiency while improving safety
- **ADS-B enables:**
 - Increased situational awareness
 - ▲ *Increased safety*
 - Operations closer to current separation standards
 - ▲ *Increased efficiency*
 - Increased throughput in marginal visibility
 - ▲ *Increased capacity*
 - Increased performance of decision support tools
 - ▲ *In the aircraft and on the ground*



Implementing ADS-B in the NAS - We're Moving Ahead

1999 2000 2001 2002 2003 2004 2005 2006

PHASE 1

ADS-B Application Development/Validation and Pockets of Implementation

- Enable operational use of ADS-B and encourage equipage
 - Limited operational approvals
 - Local “pockets” of implementation
- Make ADS-B Link Decision

Achieve Initial Highly Beneficial Capabilities EARLY

Link Decision

National Deployment Investment Decision

National Deployment

2002 2003 2004 2005 2006 2007 2008 2009 2010 +

PHASE 2

National Deployment of ADS-B Ground Infrastructure

- Development and deployment of national ADS-B air-ground and surface systems
 - Including ground infrastructure for ATC use in all domains (surface, terminal, en route)



Phase 1 - Key Activities

- **ADS-B Link Decision**
- **Standards Development**
 - 1090ES MOPS
 - UAT MOPS and SARPS
 - TIS-B MASPS
- **Strategy for Global Interoperability**
 - Joint Development of Common Applications for Near-Term
- **Application Development and Validation**
 - Safe Flight 21
- **Pockets of Implementation**
 - Alaska, Ohio Valley
 - Frederick, MD
 - Embry-Riddle University (Prescott, AZ and Daytona, FL)
 - Gulf of Mexico
- **Ground Infrastructure Design Development**

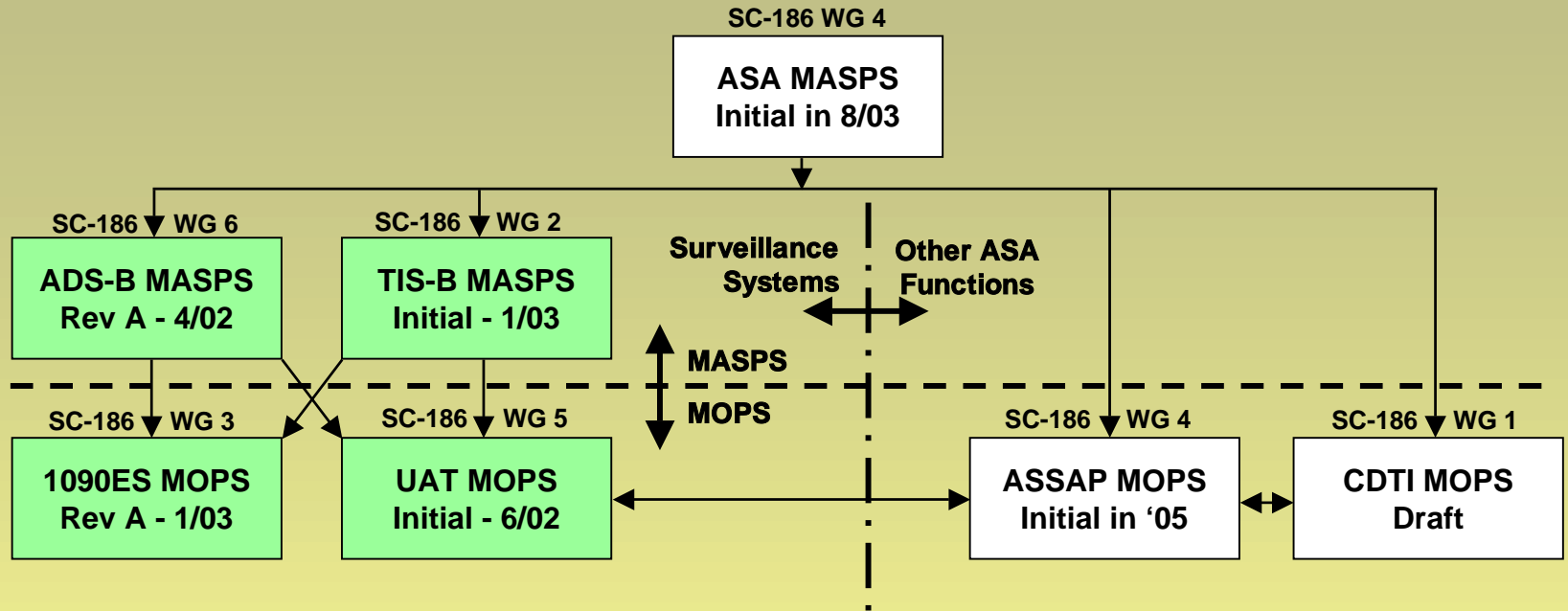


ADS-B Link Decision Made

- **On June 28, 2002 the FAA Administrator made a decision on the ADS-B link architecture to be used for the U.S.**
- **The selected ADS-B architecture utilizes a combination of:**
 - **1090 MHz Extended Squitter ADS-B link for air carrier and private/commercial operators of high performance airframes**
 - **Universal Access Transceiver (UAT) ADS-B link for the typical general aviation user**
- **The decision by the FAA also means that the agency will actively work with the aviation community to:**
 - **Develop and implement beneficial ADS-B applications, thereby stimulating user equipage**
 - **Ensure that ADS-B is globally interoperable**
 - **Develop the necessary standards**
 - **Support spectrum planning**
 - **Identify equipage requirements (for both aircraft and ground systems)**
- **For more information see: www.faa.gov/asd**



Standards Are Nearing Completion



- **RTCA SC-186 responsible for key standards**
 - Completed documents shown in green
- **ICAO SARPS also being completed**
 - 1090 ES, VDL Mode 4: completed
 - UAT: Work in progress, expected in '04/'05



Working Towards Global Interoperability

- **A common ADS-B link is needed for global interoperability**
 - **FAA and Eurocontrol have identified 1090 MHz Extended Squitter as the common link for the near term**
 - **Implies international operators desiring ADS-B services in the near term would need to equip with this link**
 - **If/when an additional global link is required, the U.S. and Europe will work together to make that selection**
- **The U.S. and Europe are working together to develop an initial set of common ADS-B applications for the near-term**
 - **Referred to as “Package I” applications in Europe; consist of 7 air-to-air and 5 air-to-ground applications**
 - **Safe Flight 21 currently evaluating most applications**
 - **Applications are consistent with the NAS Concept of Operations, and can be achieved in the near-term**
 - **Joining with Europe in a “Requirements Focus Group” to define requirements for implementing common applications**
 - **Participants will include the FAA, individual European state CAAs, EUROCONTROL, RTCA, and EUROCAE**



Aircraft Equipage is Growing

■ Equipage Supporting Pockets of Implementation

- **UPS: equipping 107 aircraft with TCAS/1090ES and cockpit displays by November 2003**
- **FedEx: will start to equip fleet with 1090ES “ADS-B Out” in April 2003**
- **Capstone: equipped 198 aircraft in Bethel region with UAT and Multi-function displays; planning similar equipage for aircraft in SE Alaska to support expansion**
- **Embry-Riddle Aeronautical University: planning to equip aircraft in Prescott, AZ (35) and Daytona, FL (75) to support flight training**

■ Standard Avionics Suites Becoming Available

- **Boeing and Airbus equipping new aircraft with 1090ES “ADS-B Out”**
 - **Airbus starting in March 2003, Boeing starting in March 2004**
 - **Australia also planning to equip aircraft for national system**
- **Garmin and others now offering Mode S transponder products that include ADS-B**



Safe Flight 21 - Nine Enhancements

- Joint government/industry effort to demonstrate 9 operational enhancements supporting free flight

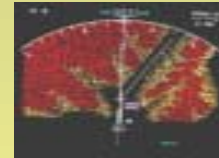
Air-to-Air

- Improved Terminal Operations in Low-Visibility Conditions*
- Enhanced See and Avoid*
- Enhanced En Route Air-to-Air Operations*



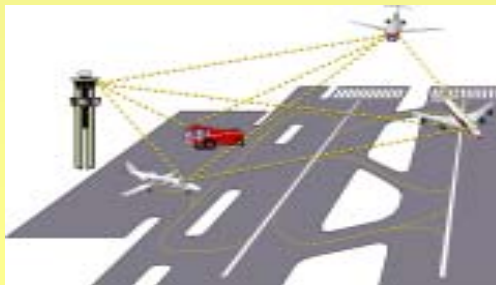
Air-to-Ground

- ADS-B Surveillance in Non-Radar Airspace*
- ADS-B Surveillance in Radar Airspace*
- Cost-Effective CFIT Avoidance



Ground-to-Ground

- Improved Surface Surveillance and Navigation for the Pilot*
- Enhanced Surface Surveillance for the Controller*



Ground-to-Air

- Weather and Other Information to the Cockpit



**Enhancements that are enabled by ADS-B*



Safe Flight 21 - Demonstrations Continuing

■ Five focus areas

– Surface

- Demonstrating surface traffic management applications
- Developing surface moving maps

– Terminal

- Developing cockpit tools, demonstrating airborne applications
- Integrating ADS-B into Common ARTS and STARS
- Evaluating terminal area multilateration technology

– General Aviation

- Developing small airport infrastructure requirements
- Demonstrating broadcast service applications (TIS-B, FIS-B)

– En Route/Oceanic

- Planning demonstration of Gulf of Mexico application

– Capstone

- Demonstrating safety-related pilot and ATC applications in Bethel region
- Expanding similar capabilities to SE Alaska





Pockets of Implementation - In Progress

- **Ohio Valley (Safe Flight 21)**
 - **Upgrading testbeds at Memphis and Louisville for operational use of selected applications**
- **Alaska (Capstone)**
 - **Implemented operational systems supporting air-air advisory applications and ATC radar-like services in Bethel region**
 - **Expanding similar capabilities to SE Alaska, concentrating on airspace in and around Juneau; statewide expansion planned**
- **Frederick, MD**
 - **Ground broadcast station installed; TIS-B service available (on UAT), others being worked**
 - **General aviation focus; coordinating development with Capstone**
- **FAA Tech Center**
 - **Test facility to support development and NAS-wide implementation**



Pockets of Implementation - Planned/Proposed

- **Embry-Riddle Aeronautical University - Cost Share**
 - Airborne safety-related (advisory) applications, flight following on ground
 - ERAU planning to equip aircraft with UAT and MFDs (35 a/c at Prescott, AZ, 75 at Daytona, FL), FAA to provide ground infrastructure
- **Gulf of Mexico**
 - Radar-like services using ADS-B for en route commercial flights through Gulf
 - Ground stations on oil platforms to provide coverage for key routes
- **North Carolina Small Aircraft Transport Systems (SATS) site**
 - Additional site with focus on general aviation
- **East Coast Broadcast Services?**
 - TIS-B/FIS-B services on UAT, focus on general aviation
 - Key sites from Frederick, MD to Daytona, FL



Strategy for Phase 2

- **Complete ADS-B ground infrastructure design and refine implementation strategy (during Phase 1)**
- **Expand infrastructure from existing pockets to remaining NAS**
 - **Leverage ASDE infrastructure (66 airports)**
 - ADS-B (both 1090ES and UAT links) in terminal and surface domains
 - TIS-B and crosslink to handle mixed equipage
 - FIS-B (on UAT)
 - **Expand similar capabilities to remaining terminal sites**
 - Terminal sites serviced by TRACONS
 - High volume air taxi and/or general aviation sites
 - **Provide radar gap-fillers**
 - En route and terminal domains (both links)
 - **Implement ADS-B in en route radar environment**
- **Promote equipage for all NAS users**
 - **Benefits/business cases to be developed**
 - **Potential rulemaking in certain cases (long-term) to be considered**
- **Path to implementation embodied in NAS Architecture**
 - **For more information see: www.nas-architecture.faa.gov**